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VIII. *A Report of the Committee appointed by the Royal Society, to consider of a Method for securing the Powder Magazines at Purfleet.*

TO the PRESIDENT and MEMBERS of the
ROYAL SOCIETY.

GENTLEMEN,

THE Society being consulted by the Board of Ordnance, on the propriety of fixing conductors for securing the powder magazines at Purfleet from lightning, and having thereupon done us the honour of appointing us a committee, to consider the same, and report our opinion; we have accordingly visited those buildings, and examined, with care and attention, their situation, construction, and circumstances, which we find as follows.

They are five in number, each about 160 feet long, and about 52 feet wide, built of brick, arched under the roof, which in one of them is slated, with a coping of lead 22 inches wide on the ridge from end to end; and the others, as we were informed,
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are soon to be covered in the same manner. They stand parallel to each other at about 57 feet distance, and are founded on a chalk rock, about 100 feet from the river, which rises in high tides within a few inches of the level of the ground, its brackish water also soaking through to the wells that are dug near to the buildings.

The barrels of powder, when the magazines are full, lie piled on each other up to the spring of the arches; and there are four copper hoops on each barrel, which, with a number of perpendicular iron bars, (that came down through the arches, to support a long grooved piece of timber, wherein the crane was usually moved and guided to any part where it was wanted) formed broken conductors within the building, the more dangerous from their being incomplete, as the explosion from hoop to hoop, in the passage of lightning drawn down through the bars among the barrels, might easily happen to fire the powder contained in them. But the workmen were removing all those iron bars (by the advice of some members of this Society, who had been previously consulted); a measure we very much approve of.

On an elevated ground, nearly equal in height with the tops of the magazines, and 150 yards from them, is the house where the Board usually meet. It is a lofty building, with a pointed hip-roof, the copings of lead down to the gutters, from which leaden pipes descend at each end of the building into the water of wells of 40 feet deep, for the purpose of conveying water forced up by engines to a cistern

in the roof. There is also a proof-house, adjoining to the end of one of the magazines, and a clock-house, at the distance of feet from them, which has a weathercock on an iron spindle, and, probably, some incompleat conductors within, such as the wire usually extending up from a clock to its hammer, the clock, pendulum, rod, &c.

The blowing up of a magazine of gun-powder by lightning, within a few years past, at Brescia in Italy, which demolished a considerable part of the town, with the loss of many lives, does, in our opinion, strongly urge the propriety of guarding such magazines from that kind of danger ; and since it is now well known, from many observations, that metals have the property of conducting lightning, and a method has been discovered of using that property for the security of buildings, by so disposing and fixing iron rods, as to receive, and convey away, such lightning as might otherwise have damaged them ; which method has been practised near twenty years in many places, and attended with success, in all the instances that have come to our knowledge, we cannot, therefore, but think it adviseable to provide conductors of that kind for the magazines in question.

In common cases, it has been judged sufficient, if the lower part of the conductor were sunk three or four feet into the ground, till it came to moist earth ; but this being a case of the greatest importance, we are of opinion that greater precaution should be taken. Therefore, we would advise, that, at each end of each magazine, a well should be dug
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in or through the chalk, so deep as to have in it at least four feet of standing water. From the bottom of this water should arise a piece of leaden pipe, to or near the surface of the ground, where it should be strongly joined to the end of an upright iron bar, an inch and half diameter, fastened to the wall by leaden straps, and extending ten feet above the ridge of the building, tapering from the ridge upwards to a sharp point, the upper 12 inches of copper, the iron to be painted.

We mention lead for the under-ground part of the conductor, as less liable to rust in water and moist places; in the form of a pipe, as giving greater stiffness for the substance; and iron for the part above-ground, as stronger, and less likely to be cut away. The pieces, of which the bar may be composed, should be screwed strongly into each other, by a close joint, with a thin plate of lead between the shoulders, to make the joining or continuation of the metal more perfect. Each rod, in passing above the ridge, should be strongly and closely connected by iron or lead, or both, with the leaden coping of the roof, whereby a communication of metal will be made between the two bars of each building, for a more free and easy conducting of the lightning into the earth.

We also advise, in consideration of the great length of the buildings, that two wells, of the same depth with the others, should be dug within twelve feet of the doors of the two outside magazines; that is to say, one of them on the north side of the north building, the other on the south side of the south
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building; from the bottom of which wells, similar conductors should be carried up to the eaves, there joining well with a plate of lead, extending on the roof up to the leaden coping of the ridge, the said plate of lead being of equal substance with that of the coping.

We are further of opinion, that it will be right to form a communication of lead from the top of the chimney of the proof-house to the lead on its ridge, and thence to the lead on the ridge of the corridor, and thence to the iron conductor of the adjacent end of the magazine; and also to fix a conductor from the bottom of the weather-cock spindle of the clock-house, down on the outside of that building, into the moist earth.

As to the board-house, we think it already well furnished with conductors, by the several leaden communications above-mentioned, from the point of the roof down into the water, and that, by its height and proximity, it may be some security to the building below it; we therefore propose no other conductor for that building, and only advise erecting a pointed iron rod on the summit, similar to those before described, and communicating with those conductors.

To these directions we would add a caution, that, in all future alterations or repairs of the buildings, special care be taken that the metalline communications be not cut off or removed.

It remains that we express our acknowledgements to Sir Charles Frederick, Surveyor-general of the Ordnance, for the obliging attention with which he
entertained

entertained and accommodated us on the day of our enquiry.

With very great respect, we are,

GENTLEMEN,

Your most obedient,

humble servants,

August 21, 1772.

H. Cavendish,
William Watson,
B. Franklin,
J. Robertson.

Mr.

Mr. WILSON's *Dissent to Part of the preceding Report.*

I Dissent from the Report above, in that part only which recommends that each conductor should terminate in a *point*.

My reason for dissenting is, that such conductors are, in my opinion, less safe than those which are not *pointed*.

Every *point*, as such, I consider as *soliciting* the lightning, and, by that means, not only contributing to *increase* the quantity of every actual discharge, but also frequently occasioning a discharge where it might not otherwise have happened.

If, therefore, we invite the lightning, while we are ignorant what the quantity, or the effects of it, may be, we may be *promoting* the very mischief we mean to prevent.

Whereas if, instead of *pointed*, we make use of blunted conductors, those will as effectually answer the purpose of conveying away the lightning *safely*, without that tendency to *increase* or *invite* it.

My further reasons for disapproving of *points*, in all cases, where conductors are judged necessary, are contained in a letter addressed to the Marquis of Rockingham, and published in the Philosophical Transactions, Vol. LIV. p. 247.

There are other reasons also, which I have to offer, for rejecting points on this *particular occasion*; and which, *were mentioned at the committee*. Those I shall lay before the Royal Society at another opportunity, for the benefit of the publick.

Royal Society House,
August 21, 1772.

Benj. Wilson.

IX. *Obser-*